

What Is Claimed Is:

1. A method of forming a prosthetic limb for attachment to a residual limb of a living animal, the method comprising:

generating a digital representation of a three-

5 dimensional surface contour that is dependent on a physical three-dimensional surface contour of at least a portion of the residual limb;

generating a digital representation of a socket of the prosthetic limb, the socket having cavity defined by an

10 interior surface, the interior surface being defined at least partially by the digital representation of the three-dimensional contour; and

15 forming the socket out of physical material using a digitally controlled layered manufacturing technique driven by the digital representation of the socket.

2. A method in accordance with claim 1 wherein the step of generating the digital representation of the socket occurs

in a manner such that the socket has an exterior surface and such that the cavity of the socket terminates at a non-planar

20 perimeter surface that bridges the exterior and interior surfaces, and wherein the step of forming the socket out of physical material occurs in a manner such that the digitally controlled layered manufacturing technique automatically forms the perimeter surface, thereby eliminating the need to form

the perimeter surface by trimming the physical material.

3. A method of forming a prosthetic limb and attaching the prosthetic limb to a residual limb of a living animal comprising:

5 forming the prosthetic limb in accordance with claim 2, the step of forming the socket out of physical material occurring in a manner such that the digitally controlled layered manufacturing technique automatically forms an access opening in the socket that extends into the cavity from the  
10 exterior surface;

attaching the prosthetic limb to the residual limb by positioning the residual limb with the liner positioned thereon at least partially into the cavity of the socket; and accessing a portion of the residual limb within the  
15 cavity of the socket through the access opening after the prosthetic limb has been attached to the residual limb.

4. A method in accordance with claim 1 wherein the step of generating the digital representation of the three-dimensional surface contour comprises electronically scanning  
20 the portion of the residual limb.

5. A method in accordance with claim 4 wherein the step of generating the digital representation of the three-dimensional surface contour comprises positioning at least one

artifact adjacent the residual limb and wherein the scanning occurs in a manner creating a plurality of digital representations of surface contours dependent on the physical three-dimensional surface contour of the portion of the 5 residual limb and on the artifact, the step further comprising aligning the plurality of digital representations of surface contours relative to each other by aligning portions of the plurality of digital representations of surface contours that are dependent on the artifact, the digital representation of 10 the three-dimensional surface contour being dependent on the aligned plurality of digital representations of surface contours.

6. A method of forming a prosthetic limb and attaching the prosthetic limb to a residual limb of a living animal 15 comprising:

forming the prosthetic limb in accordance with claim 4, the step of generating the digital representation of the three-dimensional surface contour comprising electronically scanning the portion of the residual limb with a liner positioned on the residual limb in a manner such that the 20 interior surface is also defined at least partially by the liner; and

attaching the prosthetic limb to the residual limb by positioning the residual limb with the liner positioned

thereon at least partially into the cavity of the socket.

7. A method in accordance with claim 1 wherein the step of forming the socket out of physical material using a digitally controlled layered manufacturing technique comprises 5 using the digitally controlled layered manufacturing technique to form a fitting as an integral and homogeneous part of the socket and wherein the method further comprises:

providing a prosthetic appendage portion of the prosthetic limb that is releasably attachable directly to the 10 fitting of the socket; and

attaching the prosthetic appendage portion directly to the fitting of the socket.

8. A method in accordance with claim 1 wherein the step of generating the digital representation of the socket of the 15 prosthetic limb further comprises generating the digital representation of the socket in a manner such that the socket has an exterior surface that is spaced from the interior surface and that defines a socket wall that has a thickness that extends between the exterior and interior surfaces, the 20 thickness of the socket wall varying in dimension at different portions of the socket wall, and wherein the step of forming the socket out of physical material using the digitally controlled layered manufacturing technique comprises forming

the socket wall out of the physical material using the digitally controlled layered manufacturing technique.

9. A method in accordance with claim 1 wherein the step of generating the digital representation of the socket of the prosthetic limb further comprises generating the digital representation of the socket in a manner such that the socket has an exterior surface that is spaced from the interior surface and that defines a socket wall that has a thickness that extends between the exterior and interior surfaces and in a manner such that a passageway having a non-linear trajectory is formed between the interior and exterior surfaces and extends transversely to the thickness of the socket wall, and wherein the step of forming the socket out of physical material using the digitally controlled layered manufacturing technique comprises forming the socket wall and the passageway of the socket using the digitally controlled layered manufacturing technique, the method further comprising routing an electrically conductive wire within the passageway of the socket.

20 10. A method of forming a socket of a prosthetic limb and attaching the socket to a residual limb of a living animal comprising:

positioning a liner on at least a portion of the

residual limb;

marking the liner in manner indicating a preferred contour and location of a non-planer terminal edge of the socket, the marking occurring when the liner is positioned on 5 the residual limb;

electronically scanning at least a portion of the liner when the liner positioned on the residual limb to generate a digital representation of a three-dimensional surface contour that is dependent on a physical three-dimensional surface 10 contour of the liner when the liner is positioned on the residual limb, the scanning occurring in a manner such that the contour and location of the non-planer terminal edge of the socket that has been marked on the liner is identifiable in the digital representation of the three-dimensional surface 15 contour;

generating a digital representation of the socket, the digital representation of the socket having a cavity defined by an interior surface, the interior surface being defined at least partially by the digital representation of the three- 20 dimensional contour, the digital representation of the socket also having an exterior surface and a non-planar perimeter surface, the perimeter surface terminating the cavity and bridging the exterior and interior surfaces, the perimeter surface being dependent upon the contour and location of the

non-planer terminal edge of the socket that is identifiable in the digital representation of the three-dimensional surface contour;

using a digitally controlled layered manufacturing

5 technique driven by the digital representation of the socket to form the interior, exterior, and perimeter surfaces of the socket out of physical material; and

attaching the socket of the prosthetic limb to the

residual limb by positioning the residual limb with the liner 10 positioned thereon at least partially into the cavity of the socket.

11. A method in accordance with claim 10 further comprising positioning at least one artifact adjacent the residual limb, and wherein the step of electronically scanning 15 the portion of the liner occurs in a manner creating a

plurality of digital representations of surface contours that are dependent on the physical three-dimensional surface contour of the liner and on the artifact and comprises aligning the plurality of digital representations of surface

20 contours relative to each other by aligning portions of the plurality of digital representations of surface contours that are dependent on the artifact, the digital representation of the three-dimensional surface contour being dependent on the aligned plurality of digital representations of surface

contours.

12. A method in accordance with claim 10 wherein the step of using the digitally controlled layered manufacturing technique driven by the digital representation of the socket 5 to form the interior, exterior, and perimeter surfaces of the socket out of physical material comprises using the digitally controlled layered manufacturing technique to form a fitting as an integral and homogeneous part of the socket and wherein the method further comprises:

10 providing a prosthetic appendage portion of the prosthetic limb that is releasably attachable directly to the fitting of the socket; and  
attaching the prosthetic appendage portion directly to the fitting of the socket.

15 13. A method in accordance with claim 10 wherein the step of generating the digital representation of the socket of the prosthetic limb further comprises generating the digital representation of the socket in a manner such that the exterior surface is spaced from the interior surface and 20 defines a socket wall that has a thickness that extends between the exterior and interior surfaces, the thickness of the socket wall varying in dimension at different portions of the socket wall.

14. A method in accordance with claim 10 wherein the  
step of generating the digital representation of the socket  
further comprises generating the digital representation of the  
socket in a manner such that the exterior surface is spaced  
5 from the interior surface and defines a socket wall that has a  
thickness that extends between the exterior and interior  
surfaces and in a manner such that a passageway having a non-  
linear trajectory is formed between the interior and exterior  
surfaces and extends transversely to the thickness of the  
10 socket wall, and wherein the step of forming the socket out of  
physical material using the digitally controlled layered  
manufacturing technique comprises using the digitally  
controlled layered manufacturing technique to form the  
passageway of the socket, the method further comprising  
15 routing an electrically conductive wire within the passageway  
of the socket.

15. A method of forming a socket of a prosthetic limb  
and attaching the socket to a residual limb of a living animal  
comprising:

20 positioning a liner on at least a portion of the  
residual limb, the liner having an exterior surface contour  
when the liner is positioned on the portion of the residual  
limb;  
forming a socket having an exterior surface and a

cavity that is defined by an interior surface, the forming occurring in a manner such that the interior surface of the socket has a contour that is dependent upon the exterior surface contour of the liner and occurring without a process 5 of intentionally rectifying the contour of the interior surface for the purpose of altering the bearing characteristics between the socket and the liner; and attaching the socket of the prosthetic limb to the residual limb by positioning the residual limb with the liner 10 positioned thereon at least partially into the cavity of the socket.

16. A method in accordance with claim 15 wherein the step of forming the socket comprises forming a fitting as an integral and homogeneous part of the socket and wherein the 15 method further comprises:

providing a prosthetic appendage portion of the prosthetic limb that is releasably attachable directly to the fitting of the socket; and

20 attaching the prosthetic appendage portion directly to the fitting of the socket.

17. A method in accordance with claim 15 wherein the step of forming the socket comprises electronically scanning the exterior surface contour of the liner to generate a

digital representation of the socket that is dependent upon at least a portion of the exterior surface contour of the liner, and comprises using a digitally controlled layered manufacturing technique driven by the digital representation 5 of the socket to form the socket out of physical material.

18. A method in accordance with claim 17 wherein the step of forming the socket comprises positioning at least one artifact adjacent the residual limb prior to electronically scanning the exterior surface contour of the liner, the 10 electronic scanning of the portion of the liner occurring in a manner creating a plurality of digital representations of surface contours that are dependent on the exterior surface contour of the liner and on the artifact, the step further comprising aligning the plurality of digital representations 15 of surface contours relative to each other by aligning portions of the plurality of digital representations of surface contours that are dependent on the artifact, the digital representation of the socket being dependent on the aligned plurality of digital representations of surface 20 contours.

19. A method in accordance with claim 17 wherein the step of forming the socket further comprises using the digitally controlled layered manufacturing technique to form

the socket in a manner such that the exterior surface is spaced from the interior surface and defines a socket wall that has a thickness that extends between the exterior and interior surfaces, the thickness of the socket wall varying in 5 dimension at different portions of the socket wall.

20. A method in accordance with claim 17 wherein the step of forming the socket further comprises using the digitally controlled layered manufacturing technique to form the socket in a manner such that the exterior surface is 10 spaced from the interior surface and defines a socket wall that has a thickness that extends between the exterior and interior surfaces and in a manner such that a passageway having a non-linear trajectory is formed between the interior and exterior surfaces and extends transversely to the 15 thickness of the socket wall, the method further comprising routing an electrically conductive wire within the passageway of the socket.

21. A prosthetic limb for attachment to a residual limb of a living animal comprising:

20 a socket formed by a digitally controlled layered manufacturing technique, the socket having a cavity defined by an interior surface, the interior surface being dependent on a physical three-dimensional surface contour of at least a

portion of the residual limb.

22. A prosthetic limb in accordance with claim 21  
wherein the socket further comprises a fitting formed as an  
integral and homogeneous part of the socket via the digitally  
5 controlled layered manufacturing technique.

23. A prosthetic limb in accordance with claim 21  
wherein the socket has an exterior surface that is spaced from  
the interior surface and that defines a socket wall that has a  
thickness that extends between the exterior and interior  
10 surfaces, the thickness of the socket wall varying in  
dimension at different portions of the socket wall.

24. A prosthetic limb in accordance with claim 21  
wherein the socket has an exterior surface and a non-planar  
perimeter surface, the perimeter surface terminating the  
15 cavity and bridging the exterior and interior surfaces, the  
perimeter surface being non-planar and being formed by the  
digitally controlled layered manufacturing technique.

25. A prosthetic limb in accordance with claim 21  
wherein the socket has an exterior surface that is spaced from  
20 the interior surface and that defines a socket wall that has a  
thickness that extends between the exterior and interior  
surfaces, the socket further comprising a passageway formed  
between the interior and exterior surfaces, the passageway

having a non-linear trajectory that extends transversely to the thickness of the socket wall, the passageway being formed by the digitally controlled layered manufacturing technique.